

CAT. NO. 26-1130

TRS-80®
Model 4

**Hard Disk System
Start-up Manual**



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Addendum

TRS-80 Model 4P Hard Disk Users

When starting up or resetting your Model 4P, you must press <F2> if your hard disk is connected and turned on. This tells TRSDOS to boot from Floppy Drive Ø.

Follow these steps:

1. Reset your Model 4P.
2. Press <F2> within a few seconds of pressing RESET.

If you plan to boot the hard disk, have your boot disk in Drive Ø. If you want to operate under floppy control, have your operating system diskette in Drive Ø.

More information on function keys used during system start up is given in Appendix A of the Introduction To Your Disk System manual.

Thank You

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TRS-80®

TRS-80 MODEL 4 HARD DISK SYSTEM

START-UP MANUAL

Radio Shack®

TRS-80®

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TO OUR CUSTOMERS ...

Congratulations for adding the 5-Megabyte Hard Disk to your TRS-80 Model 4. It comes with:

- More storage space
(The hard disk can store about 30 times as much information as a single floppy diskette.)
- Higher reliability
(The hard disk is more durable than a floppy diskette.)
- A flexible operating system
(TRSDOS Version 6 can be used for your hard disk system as well as for your floppy diskette system.)

ABOUT THIS MANUAL ...

This manual explains how to start up your Model 4 Hard Disk System. It shows you how to connect, start up, and move all your programs and data to the hard disk.

Details on TRSDOS Version 6 are in the Model 4 Disk System Owners Manual.



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Section One / YOUR HARD DISK DRIVE

Unlike a floppy diskette, you cannot remove a hard disk from its drive. Besides this, the only other differences you should notice is that a hard disk drive can store and retrieve data faster and has more storage space.

If you have only one hard disk drive, it is the "primary drive." A small area on this drive may be used to store the operating system. You might also have up to three "secondary drives" for storing additional data.

CONNECTIONS

If you haven't set up your Model 4 yet, do so now using the Introduction to Your Disk System manual as a guide. Then connect your primary drive and any secondary drives you have as described in this section. Figure 4 shows a fully configured system.

Connecting Your Primary Drive

Carefully unpack your 5-Megabyte Hard Disk Drive. Included with it should be:

- . Hard Disk Reference Manual (for Model III mode only.)
- . Model III Hard Disk Start-Up Manual
- . Model III HARD DISK OPERATING SYSTEM DISKETTE
- . Model III INITIALIZATION Diskette
- . Hard Disk Expansion Cable (50-pin)
- . Power Cord
- . Power Key

Your Model 4 Hard Disk Drive package contains the following:

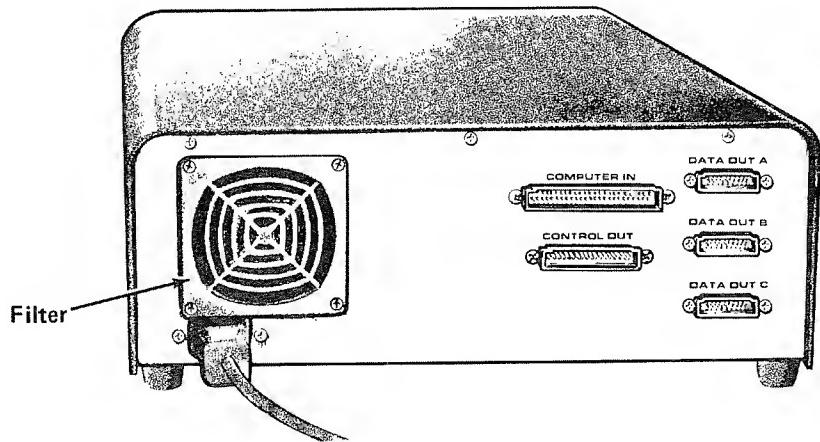
- . Model 4 Hard Disk Start-up Manual (this manual)
- . Model 4 Hard Disk INITIALIZATION Diskette

Locate the hard disk expansion cable. Connect one end to the I/O bus card edge of your Model 4. Be sure the cable exits the rear of the computer so that it won't bind.

Connect the opposite end of this cable to the COMPUTER IN connector, located on the rear panel of the primary drive.

Connect the power cord to the primary drive. Plug the other end into an appropriate AC power source.

Figure 1. Back Panel of Primary Hard Disk Drive



1. Computer In (50-pin) Connect the Hard Disk Expansion Cable from the I/O bus card edge of the Model 4 to this jack.
2. Control Out (34-pin) Connect one end of a Secondary Hard Disk Expansion Cable to this connector. The other end connects to the first secondary drive.
3. Data Out A (20-pin) Connect one end of the Data Cable from the first secondary drive to this connector.
4. Data Out B (20-pin) Connect one end of the Data Cable from the second secondary drive to this connector.
5. Data Out C (20-pin) Connect one end of the Data Cable from the third secondary drive to this connector.
6. Filter Clean this filter whenever it becomes filled with dust and particles. To clean the filter, turn off your hard disk drive. Then carefully remove the outer grill -- DO NOT REMOVE THE SCREWS. Then remove the filter and rinse with tap water. When the filter is completely dry, put it back in the drive.

Connecting Your Secondary Drives

Before connecting your secondary hard disk drives, you need to take all your hard disk drives to a Radio Shack computer technician to have them modified. After the modification, only one drive is labeled as a terminator. This should always be the last drive in the chain.

Note: If you have been using the Hard Disk System and are adding a secondary drive, be sure to back up all the information onto floppy diskettes before you have your hard disk drives modified. This modification could erase all the information you have previously stored on your hard disk drives. Section Four shows how to save your files.

Connections

Included with your secondary hard disk drives should be:

- Secondary Hard Disk Expansion Cable
- Data Cable and a Power Cable

The secondary drives are connected to the computer via the primary disk drive. The drives must be stacked with the primary drive on top of the secondary drives.

Locate the secondary hard disk expansion cable. Connect one end to the **Control In** jack of the secondary drive and the other end to the **Control Out** jack of the previous drive in the chain. If you have only two hard disk drives, this connector connects to the primary drive.

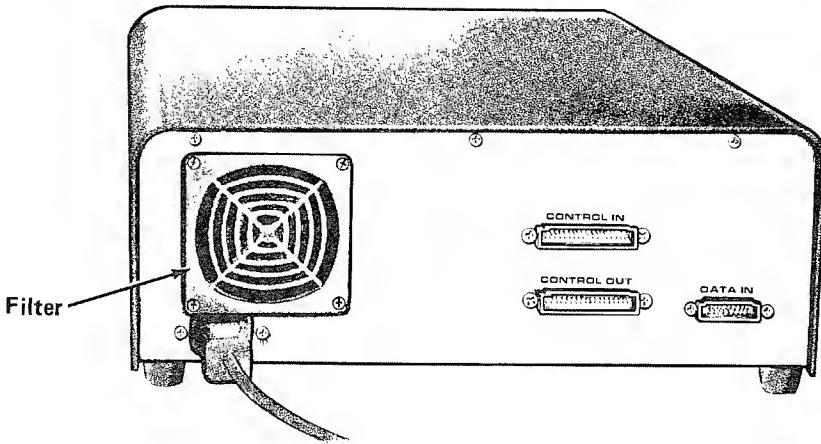
If you have another secondary drive, connect the second secondary hard disk expansion cable to the **Control Out** jack and the other end to the **Control In** jack of the next drive in the chain.

Locate the data cable. Connect one end to the appropriate data jack (A for the first secondary drive, B for the second, and C for the third). Connect the other end to the **Data In** jack on the secondary drive.

Connect the power cord to the drive. Plug the other end into an appropriate AC power source.

The drive with the terminator must be the last drive in the series. See Figure 3.

Figure 2. Back Panel of Secondary Hard Disk Drive



1. **Control In** (34-pin) Connect one end of a Secondary Hard Disk Expansion Cable to this jack. The other end connects to the previous Hard Disk Drive.
2. **Control Out** (34-pin) Connect one end of a Secondary Hard Disk Expansion Cable to this jack. The other end connects to the next secondary drive.
3. **Data In** (20-pin) Connect one end of the Data Cable from the primary drive to this jack.
4. **Filter** Clean this filter whenever it becomes filled with dust and particles. To clean the filter, turn off the hard disk drive. Then carefully remove the outer grill -- DO NOT REMOVE THE SCREWS. Then remove the filter and rinse with tap water. When the filter is completely dry, put it back in the drive.

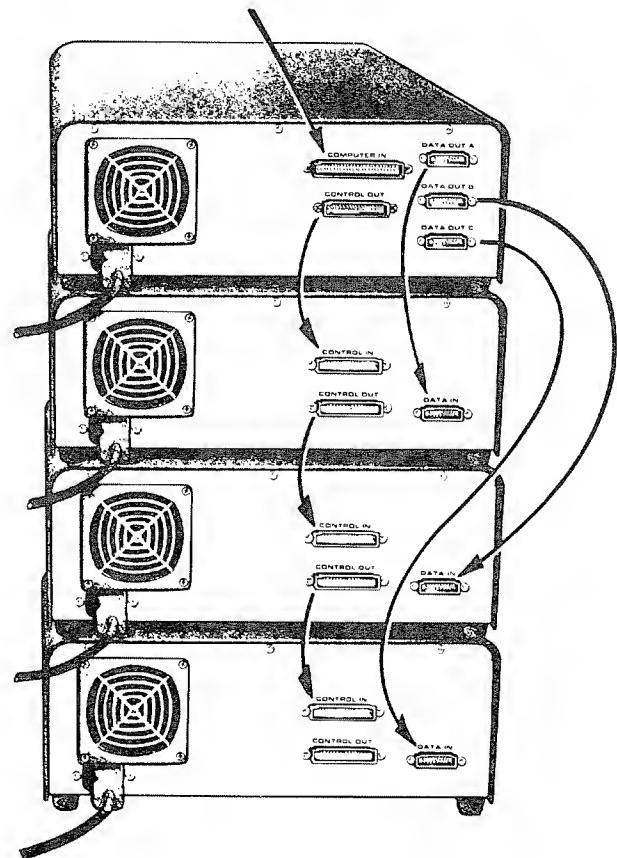
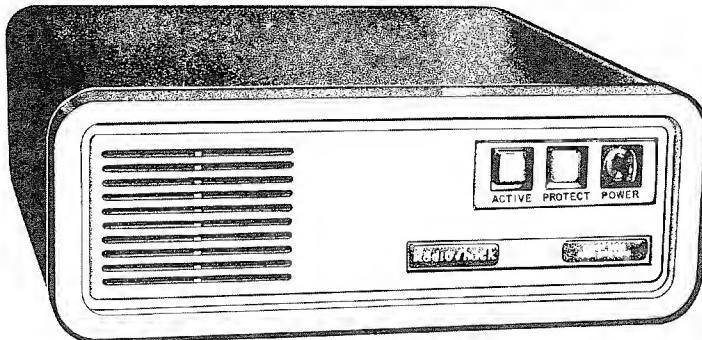


Figure 4. A Fully Configured Hard Disk System

ABOUT YOUR HARD DISK DRIVE

Figure 5 shows how to power-up and write-protect your hard disk drive.

Figure 5. The Hard Disk Drive



1. **power key** -- this is on the primary drive only. It controls the power to all the hard disk drives. Turn it clockwise to turn the drives on; counterclockwise to turn them off.

It's a good idea to turn on the drives, then remove the key until you're ready to turn them off. If you lose your key, the nearest Radio Shack Computer Center can replace it.

2. **power light** -- this is on all secondary drives. When the light is on, the drive is powered up.
3. **drive active light** -- when illuminated, the drive is currently selected for use. When off, the drive is either (1) not being used and not ready for use, or (2) being used.

Only one drive can have this light on at a time. When you're using two drives in rapid succession, more than one light may appear to be on when it's not.

If more than one light is actually on, turn the system off, wait a few minutes, and turn it on again. If the problem recurs, contact a Radio Shack service technician.

4. **write-protect switch** -- when illuminated, the disk drive is write-protected. You cannot write (change information) on it.

Pressing the switch turns the light on and off. Press this switch only when the drive is not in use. Otherwise, data may be lost or destroyed.

*
* **WARNING:**
*
* NEVER move the your hard disk drive while the *
* drive is running. Permanent damage to the drive *
* or disk may occur if the drive is moved while it *
* is running.
*
* Also, do not expose a hard disk to a strong *
* magnetic field (such as a bulk eraser). You *
* could lose valuable data or damage the unit.
* Remember, you cannot bulk erase a hard disk.
*



Section Two / POWER-UP AND POWER-DOWN

Using the proper sequence to power up and power down your system will help ensure that you do not lose important information.

SYSTEM POWER-UP

1. Make sure all floppy diskette drives are empty. Turn on all peripheral equipment (such as a printer or additional floppy diskette drives).
2. Turn on the primary hard disk drive by turning the POWER KEY clockwise. This also turns on all secondary drives. Wait for all secondary drives power lights to come on.
3. Turn the computer ON. If you are using a TRS-80 power strip, you can turn on all components of your system at once.
4. Insert either the Model 4 TRSDOS Version 6 diskette or the BOOT diskette in floppy Drive Ø.

The BOOT diskette is a modified copy of your INITIALIZATION diskette created during initialization. Initialization procedures are described later in this manual.

IMPORTANT: If you have not yet initialized your hard disks, start up using the TRSDOS Version 6 diskette that came with your computer.

5. Press RESET. In a few seconds the screen shows the TRSDOS start-up message.

If the TRSDOS start up message does not appear, repeat the above steps, making sure you inserted the diskette properly. If an error message appears, look it up in Appendix E.

6. At the bottom of the screen, TRSDOS asks you for the date. Enter today's date as requested. For example, for June 17, 1982, type:

Ø6/17/82 <ENTER>

7. TRSDOS then displays the name and date of the diskette above the start-up message. It also displays the expanded date below the message.
8. The screen then shows this prompt:

TRSDOS Ready

If you've not yet initialized your Hard Disk System, your computer is now operating as a Floppy Disk System, the only way it can operate until you initialize it.

If you've initialized your Hard Disk System, you can remove the BOOT diskette. You only need it to start up or reset.

If you want to operate your system for floppy disks only, use the TRSDOS Version 6 diskette to start up instead of the BOOT disk.

If you are using the boot disk and want to operate the system for floppy disks only, hold down the <CLEAR> key and press the RESET button. (You must keep the <CLEAR> key down until TRSDOS Ready appears.)

Note: If your hard disk drives are turned off, the system displays an "H" in the upper right corner of the screen. It then waits until you turn your hard disk drives on or until you press RESET and hold the <CLEAR> key down.

SYSTEM POWER-DOWN

1. The TRSDOS Ready prompt should be the last line on your screen. If not, press <ENTER> or exit your program so that it appears.
2. Remove all floppy diskettes from their drives.
3. Turn off any peripheral equipment.
4. Turn off the hard disk drive by turning the power key on the primary drive counterclockwise. This turns off all the drives.
5. Turn off the computer. If you are using a TRS-80 power strip, you can turn off all components of your system at once.

BEFORE GOING ON

Start up your system with your TRSDOS Version 6 diskette and make a backup of your Model 4 Hard Disk INITIALIZATION diskette. This is very important since this disk is modified during the initialization process.

Refer to the backup instructions given in the Introduction to Your Disk System manual.

Section Three / INITIALIZING YOUR HARD DISK SYSTEM

Although you've set-up and perhaps turned on your hard disk drives, your computer cannot use them. You still have a Floppy Disk System.

To make your system a Hard Disk System, you need to initialize it. To do this, you must:

- Format all your hard disk drives
- Configure these drives into your computer system
- Copy TRSDOS Version 6 onto your hard disk system

TRSDOS has an easy-to-use program called HARDGEN which does all this for you.

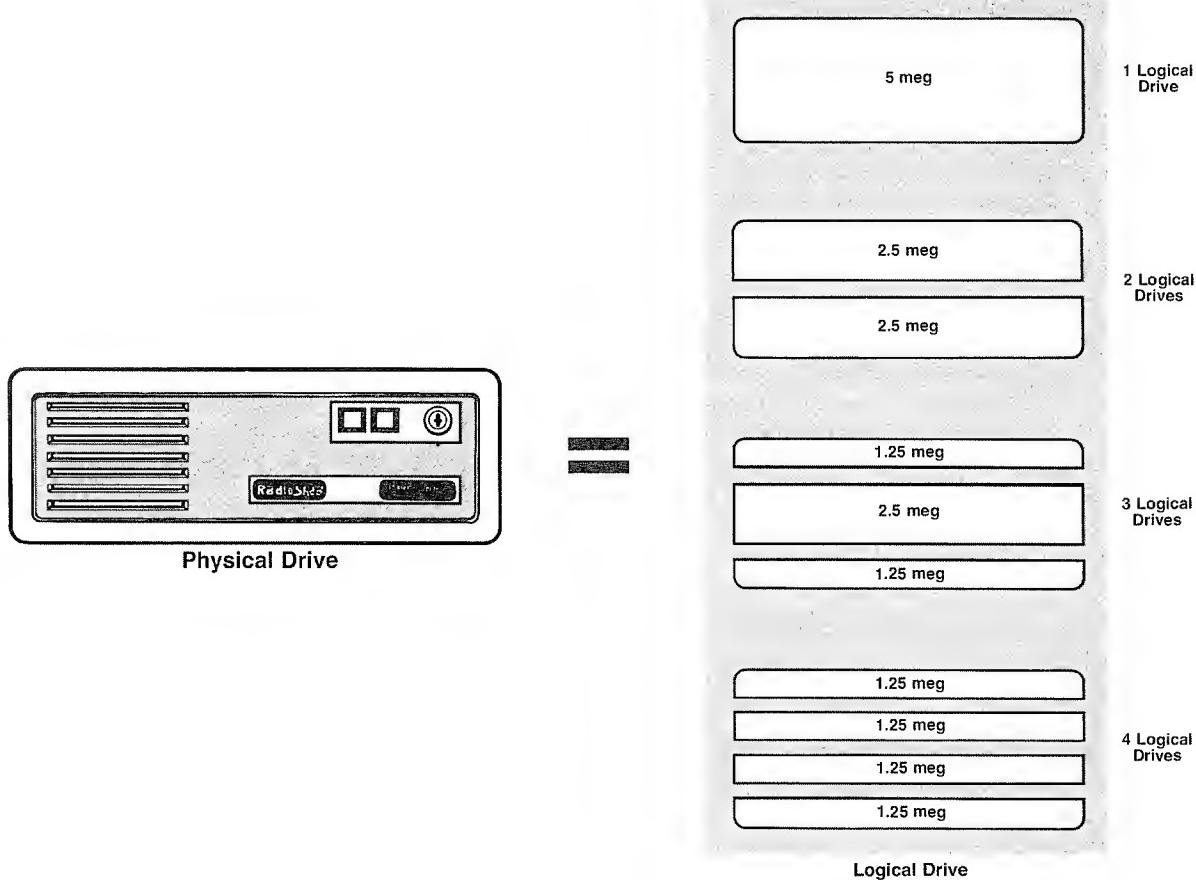
Before getting started with the initialization, please read the next section carefully. It explains the difference between "physical" and "logical" drives. It is important that you understand the difference before initializing your hard disk system. Once the initialization process is complete, the operating system expects only logical drive numbers.

Important: If you are re-initializing your hard disk, be sure to backup all information currently stored on the disk. This initialization procedure totally erases all information you have stored on all your hard disk drives. There will no way to recover it!

Also, backup all information stored on the hard disks when adding another hard disk to your system.

PHYSICAL DRIVES VS LOGICAL DRIVES

A physical drive is the actual piece of hardware. A physical drive can be divided into partitions called logical drives. The drawing below illustrates this concept:



With floppy disk drives, a physical drive always equals a logical drive.

Hard disk drives can be divided into logical drives by their read/write heads. There must be at least one read/write head for each logical drive. A partial head cannot be assigned. For example, you can assign head 1 to logical drive 1, and heads 2,3,4 to logical drive 2. So even though you have only one hard disk drive (one physical drive), you have two logical drives. Each logical drive has its own individual directory and files.

INITIALIZATION STEPS

To initialize your hard disk you need a backup of the Model 4 Hard Disk INITIALIZATION diskette.

You should also write down the serial number for each of your hard disk drives. TURN OFF the drives before doing this. The serial number is located on the bottom of the drive.

1. Insert the INITIALIZATION backup disk into Floppy Drive Ø. Make sure the disk is write-enabled. Press the Reset button. Enter the date if you are prompted to do so. The Hard Disk System Generator program starts automatically.
2. The system asks if your system is ready. If you have properly connected your hard disks, type <Y> <ENTER>.
3. The system then asks how many floppy drives and how many hard disk drives are connected to your system. Answer the prompts with the appropriate number.

Hint: If you think you might purchase more floppy drives in the future, you can enter a number greater than the number drives you really have connected. This applies only to floppy drives. You must enter the exact number for hard disks.

4. Now, the system wants you to enter the serial number for each hard disk. If your drives are turned on, it prompts you to turn them off before looking for the serial number. When they are off, the system prompts you for the serial numbers one at a time. First, the primary, followed by each secondary drive (A, B, then C).

Enter the complete serial number, including hyphens if present. It is important that you enter the corresponding serial for each drive. Do not enter them in the wrong order.

5. You may also be asked to enter the size of the hard disk. For example, 5 for 5-meg.

6. The screen displays a message telling you to decide how many logical drives you want to assign. Logical and physical drives were discussed earlier.
7. The system asks:

How many logical drives do you want on your system?

The system shows you a range <m to n> where m is the number of hard disks + 2 and n is the maximum number allowed. You should specify the number of logical drives you want your system to contain. Keep in mind that the more logical drives available, the more partitions you can have on your hard disk drives.

How many floppy drives do you want to use?

Again the system shows a range <l to n> where n is the number floppy drives you specified in Step 3. You may enter a number less than the number of drives you own and thereby reserving more logical drives for the hard disks. The other drives are disabled. You must specify at least 1 floppy drive. Most applications can be used with just one or two floppy drives when running hard disk drives.

Do you want to reserve a logical drive for use with Memdisk?

Your Model 4 Disk System Owner's Manual describes Memdisk. You can still use Memdisk even if you answer this prompt NO. To do so, however, you must disable another drive while using Memdisk.

How many logical drives do you want for your hard disks?

Enter a number in the range shown. Remember, the more logical drives you assign, the more partitions you can have.

8. The system asks if you are satisfied with your answers. If you want to change any of your answers, answer <Y> <ENTER>. If you are satisfied, answer <N> <ENTER>.

Dividing Disk Space On Your Hard Disks

9. Most likely, at least one of your hard disk drives will be divided into two or more logical drives. There are three ways this division of disk space can be done. They are:

- A) Divide up the space as evenly as possible.
Where possible, the system tries to allocate the same amount of space for each logical drive. If this cannot be done due to physical limitations, it is divided as close as possible.
- B) Give more space to the higher numbered drives.
This is useful to systems with large data bases, such as payroll, and accounting packages. These are systems that need more space on the DATA DISK drives.
- C) Give more space to the lower numbered drives.
This is preferred by many software development systems.

Enter the appropriate letter for your selection.

10. The system displays a graphic representation of your system which shows the logical drive number and a description of the space given to it. The system asks:

Do you want a hard disk to be the system device?
<Yes or No>

If you want TRSDOS Version 6 stored on the hard disk, answer <Y> <ENTER>. If you want the operating system stored on a floppy disk, answer <N> <ENTER>.

11. You must now decide which drives you want to be first in TRSDOS's search sequence. That is, when TRSDOS searches for a file, should the hard disk drives be searched first or the floppy drives.

Since the hard disk drives can be searched faster than the floppy drives, this may be your best choice.

If you want the hard disks searched first, answer <Y> <ENTER> to the appropriate prompt.

12. The screen displays the resulting configuration one last time and asks if it is acceptable.

The configuration shown on the screen tells you what logical drives are on each hard disk drive. If you would like a hard copy of the system layout, press <CTRL><:> to send it to the printer.

Next, if the configuration is not acceptable, answer <N> <ENTER>, otherwise answer <Y> <ENTER>.

If you answer YES, then TRSDOS Version 6 begins the format and setup procedure. This takes a few minutes.

13. For each logical drive that is formatted, TRSDOS asks for a Disk Pack Name and a Master Password. You may press <ENTER> to use the default values or enter in a name of your choice.

Note: You may be asked to turn the drives on or to write-enable them.

The Disk Pack Name defaults to the following:

HARDA 1st logical drive
HARDB 2nd logical drive
HARDC 3rd logical drive
:
:

The Master Password defaults to PASSWORD.

14. TRSDOS also asks:

Are you sure you want to format the hard disk:
Any data on them may be erased.
To proceed, type 'YES' and press <ENTER>.

To continue, type the complete word <Y><E><S> and press <ENTER>. You must type the entire word.

If you answer the prompt incorrectly, the system returns to TRSDOS Ready. To continue the initialization process, type:

DO HDJCL <ENTER>

Important: DO NOT STOP the initialization procedure after this point. If you stop the initialization for some reason, you must start the entire procedure over again with a new backup of the Model 4 Hard Disk INITIALIZATION diskette.

15. When the formatting is complete, press <ENTER>.

If you answered earlier that the hard disk drive should be the system drive, TRSDOS asks you to insert your Model 4 TRSDOS diskette into Drive Ø. Once you have done this, press <ENTER>. TRSDOS copies files from the diskette to the hard disk.

16. If you changed disks, TRSDOS asks you to re-insert the Model 4 Hard Disk Initialization backup diskette. When you are ready, press <ENTER>. If the Initialization diskette is still in Drive Ø, then press <ENTER> when TRSDOS prompts you to.

This creates the BOOT disk. When TRSDOS Ready appears, press the RESET button to boot up the hard disks.

SUGGESTED DEFAULT ANSWERS

The following chart gives default answers that you can give to the prompts during initialization. This sets your hard disk system to a configuration usable by most applications.

Legend: f.d. means floppy drive
h.d. means hard disk drives

TRSDOS Prompt	Number of Drives on Your System			
	1 f.d. 1 h.d.	2 f.d. 1 h.d.	1 f.d. 2 h.d.	2 f.d. 2 h.d.
How many floppy drives are connected to your system? <1 to 4>	<1>	<2>	<1>	<2>
How many hard disk drives are connected to your system <1 to 4>	<1>	<1>	<2>	<2>
What is the serial number of the primary hard disk (The primary drive has the key switch on the front) >	serial number	serial number	serial number	serial number
What is the serial number of the first secondary drive? (If you have more than one secondary drive, look on the back of the primary drive and follow the cable that is connected to the "Data Out A" jack) >	N/A	N/A	serial number	serial number
How many logical drives do you want to have on your system? <x to x>	<8>	<8>	<8>	<8>
How many floppy drives do you want to use?	<1>	<2>	<1>	<2>
Do you want to reserve a logical drive for use with Memdisk? (Replying no does not mean you cannot use Memdisk. However, you may have to disable another drive while using Memdisk.) <Yes or No>	<N>	<N>	<N>	<N>

		Number of Drives on Your System			
TRSDOS	Prompt	1 f.d.	2 f.d.	1 f.d.	2 f.d.
		1 h.d.	1 h.d.	2 h.d.	2 h.d.
<hr/>		<hr/>			
How many logical drives do you want to use on your hard disk <x to x>		<4>	<4>	<4>	<4>
<hr/>		<hr/>			
Do you wish to change any values <Yes or No>		<N>	<N>	<N>	<N>
<hr/>		<hr/>			
Which method would you prefer <A,B, or C>		<A>	<A>	<A>	<A>
<hr/>		<hr/>			
Do you want a hard disk to be the system device <Yes or No>		<Y>	<Y>	<Y>	<Y>
<hr/>		<hr/>			
Do you want the hard disk drives to be searched first when the system is looking for a file <Yes or No>		<Y>	<Y>	<Y>	<Y>
<hr/>		<hr/>			
Is the configuration acceptable <Yes or No>		<Y>	<Y>	<Y>	<Y>
<hr/>		<hr/>			

OPERATING AS A HARD DISK SYSTEM

Start up or reset the computer with the BOOT diskette in floppy Drive Ø. When TRSDOS Ready appears, type this command:

```
DIR :4 <ENTER>
```

TRSDOS shows a directory of the files contained in your BOOT diskette (assuming that your first floppy drive is logical Drive 4). Type:

```
DIR :Ø <ENTER>
```

TRSDOS shows a directory of the Hard Disk System's Drive Ø (assuming that your primary hard disk is assigned as logical Drive Ø).

This is what actually happened:

When you first turned on or reset the computer, it knew only about floppy Drive Ø. It went to floppy Drive Ø to find an operating system.

In floppy Drive Ø, it found your BOOT diskette. This diskette contained a logical drive configuration file.

The configuration file told the computer how many hard disk drives and floppy drives are on your system. It also told the system where the logical drives are located and how much storage space each logical drive contains.

The computer then went to your primary hard disk drive in search of an operating system. If the hard disk is turned off or disconnected, an "H" appears in the upper right corner of the screen. If the hard disk is on but not yet ready to perform an operation, a blinking "H" appears. When the drive becomes ready, the "H" disappears and the system begins using the hard disk.

There, it found TRSDOS, showed the TRSDOS Ready prompt, and executed your commands.

With your system configured as a Hard Disk System, you can now remove your BOOT diskette. The computer will continue to use the Hard Disk System's drive numbers until you turn it off or reset it. The DEVICE command displays the configuration of your system.

OPERATING AS A FLOPPY DISK SYSTEM

The computer operates as a Hard Disk System only because the configuration file tells it to. To operate as a Floppy Disk System, do one of the following:

- Remove the BOOT diskette from floppy Drive Ø and insert any other operating system diskette. Press RESET. (Only the BOOT diskette contains the hard disk configuration file.)

or

- Leave the BOOT diskette in floppy Drive Ø but tell the computer to ignore its configuration file. Press the <CLEAR> key. Keep holding <CLEAR> down while you press RESET and wait for TRSDOS Ready to appear. (If starting up the computer, hold down <CLEAR> after entering the date.) See the BOOT and SYSGEN library commands for more information.

(If you don't do this correctly, try it again.)

To see that your system is now a Floppy Disk System, type (at TRSDOS Ready):

DEVICE <ENTER>

and the screen shows the physical devices and their assigned logical device numbers. Type:

DIR :Ø <ENTER>

and TRSDOS shows a directory of the diskette in floppy Drive Ø.

NOTE: If your system is still responding as a Hard Disk System, you probably did not keep the <CLEAR> key pressed as long as you need to. Try again.

Here, the computer went to floppy drive Drive Ø, just as before.

Section Four / USING APPLICATION PROGRAMS

You can use your Model 4 application programs just as you always have. Simply start up your system with the application program diskette, rather than the BOOT diskette. Follow the steps in the application manual.

MOVING YOUR PROGRAMS TO HARD DISK

A much better option is to move your Model 4 application programs to the hard disk. Use the COPY or BACKUP commands to do this.

The COPY Command

The syntax for the COPY command is:

COPY source TO destination

Use the COPY command only if you know the name of the files you want to copy to the hard disk. For example, to copy a file called MYACCTS/BAS to the hard disk, the command might be:

COPY MYACCTS/BAS:4 :Ø <ENTER>

This assumes that logical Drive 4 is a floppy drive and logical Drive Ø is a hard disk. You should use the drive numbers that correspond to your system.

The BACKUP Command

The syntax for the BACKUP command is:

BACKUP source drive TO destination drive (NEW,INV)

Use the BACKUP command to copy all files from one disk to another. For example, to move all user files that do not

already exist on the hard disk, the command might look like this:

```
BACKUP :4 :Ø (NEW,INV) <ENTER>
```

This assumes that logical Drive 4 is a floppy drive and logical Drive Ø is a hard disk. You should use the drive numbers that correspond to your system.

To run the application program, follow the instructions in your Disk Systems Owner's Manual.

BACKING UP A HARD DISK

To safeguard the information you have stored on hard disk, you should periodically make a backup copy on floppy diskettes:

1. Start-up or reset the computer with the START-UP diskette.
2. Determine how many TRSDOS-formatted floppy diskettes you need. (You may need up to 28 diskettes.)

To do this you need to look at the directory for that disk. Type the DIR command followed by the hard disk drive number and then (A,I,S). For example:

```
DIR :1 (A,I,S) <ENTER>
```

shows the total space consumed by the files on logical hard disk drive 1.

At the bottom of the display is the message "Space =" followed by a number. This number represents the total amount of space occupied by all the files on the drive. The number is shown in K bytes.

(There is no limit to the total amount of space. However, if the directory shows that an individual file exceeds 174K bytes, you need to use HDCOPY4 to copy that file. See Appendix A.) The column labeled File Size indicates the amount of space each file uses on that disk.

Next divide this number by 174. (A newly formatted floppy diskette can hold around 174K or 178,176 bytes.) Round up the result to the next whole number.

For example, if the "Space =" message shows the total space to be 435K, you need three floppy diskettes:

$$435 / 174 = 2.5 \text{ (rounded up = 3)}$$

3. Format the number of floppy diskettes you need. (It is a good idea to format one extra in case of a problem.)

Place one of the formatted diskettes in a floppy drive. Then type the BACKUP command. For example:

BACKUP source drive destination drive <ENTER>

copies each file on source drive to the floppy diskette in destination drive. (The message Backup Reconstruct Invoked appears on the screen. Then, the screen shows the name of each file as it is being copied.)

Note: If any files on your hard disk are larger than 174K , you may have to use the QUERY option of BACKUP to skip them. See your Disk System Owner's Manual for information.

When the floppy diskette becomes full, TRSDOS prompts you to insert a newly formatted diskette. Remove the diskette currently in Drive 4, insert a newly formatted diskette, and press <ENTER>.

When TRSDOS Ready appears, the BACKUP is complete.

Note: It is not unusual for a file to use less space on a floppy diskette than on a hard disk.



Appendix A / COPYING A LARGE HARD DISK FILE

In some cases, a file on the hard disk is too large to copy to a single floppy diskette. For this reason, TRSDOS has a utility called **HDCOPY4/BAS**. This utility can copy a large hard disk file onto several floppy diskettes.

COPYING A LARGE FILE

Before copying a hard disk file, be sure you have enough TRSDOS formatted floppy diskettes. You should also have at least one spare in case one of the diskettes is flawed.

A newly formatted diskette can hold around 174K (178,176) bytes. To find out how many bytes your hard disk file contains, look at the directory "allocation table". To do this, type the DIR command followed by the hard disk drive number and then (A). For example:

```
DIR :1 (A) <ENTER>
```

shows the total space consumed by the files on hard Disk drive 1.

The column labeled **File Size** indicates the amount of space that the given file uses on the disk.

Next divide this number by 174. (A newly formatted floppy diskette can hold around 174K or 178,176 bytes.). Round up the result to the next whole number.

For example, if the the directory allocation table shows a file to be 435K, you need three floppy diskettes:

$$435 / 174 = 2.5 \text{ (rounded up = 3)}$$

After gathering enough formatted diskettes, you can run the **HDCOPY4** utility (actually a BASIC program). Type:

```
BASIC HDCOPY4/BAS <ENTER>
```

HDCOPY4 then shows a main menu:

HDCOPY4 - Disk file Backup Utility - Ver. 5.1
Copyright (C) 1982 by Logical Systems, Inc.

<C> Create Backup copy
<R> Read in Backup copy
<@> to Exit

Your Selection ?

Press <C> <ENTER>. The screen shows:

HDCOPY4 - Disk file Backup Utility - Ver. 5.1
Copyright (C) 1982 by Logical Systems, Inc.

CREATING Backup files

Enter SOURCE Drive ?

Enter the source drive. For example, if the disk file you want to copy is on hard Disk drive 1, type:

1 <ENTER>

TRSDOS asks:

Enter DESTINATION drive ?

Place a TRSDOS-formatted diskette in Drive 4 and type:

4 <ENTER>

TRSDOS asks:

Enter filespec ?

Enter the file name, including any extension or password of the file to be copied. Do not enter the drive number.

For example:

EXAMPLE/BAS <ENTER>

TRSDOS then copies the file, showing the number of records it is copying. When the floppy diskette is full, TRSDOS shows:

Destination disk is full - insert new disk and hit <ENTER>
SOURCE errors detected and marked

(the second line only appears when a source error has occurred)

Remove the floppy diskette and insert a new one. Press <ENTER> and TRSDOS continues until all the records are copied.

Each time you insert a floppy diskette, HDCOPY4 checks it for any problem. If it finds one, it shows an error.

When finished, TRSDOS lets you know if it found any defected records. It then returns you to the main menu. Press <@> to return to TRSDOS Ready.

You now have a backup of your hard disk file. We suggest that you number and label each floppy diskette with the date and the name of the file. The file cannot be used while it is on floppy diskettes, it has to be restored to the hard disk to be used.

Since the backup file is on more than one diskette, you cannot retrieve it in the normal way. Because of this, HDCOPY4 offers a Read option which restores a backup copy to the hard disk.

RESTORING A FILE WITH HDCOPY4

To restore the "HDCOPY4" file back to its original state, HDCOPY4 offers:

Read in Backup copy

This option restores a multiple diskette file back to its original state on the hard disk.

To use it, load the HDCOPY4 utility. Then, at the main menu, press <R> <ENTER>. The screen shows:

Reading Backup files

Enter SOURCE drive ?

Insert the first diskette of the backup file into a drive and enter the drive number. HDCOPY4 asks:

Enter DESTINATION drive ?

Enter the hard disk drive number where you want to store the file. HDCOPY4 asks:

Enter filespec ?

Enter backup file's name. This must be the same name you used to create it.

HDCOPY4 then begins moving each record in the file, checking each record as it moves it. After copying the first diskette, it prompts you to insert the second diskette.

You can copy the diskettes in any order. HDCOPY4 places all the records in their proper location.

When finished, HDCOPY4 returns to the main menu. Press <@> to return to TRSDOS Ready.

HDCOPY4 ERRORS

These are error messages you might get while using HDCOPY4:

DESTINATION disk I/O error -- the record number shown on the screen contains an error. You can continue the copy by pressing <ENTER>. However, TRSDOS does not copy any record with the error. To abort the copy, press <@>.

DESTINATION disk is flawed - Copy suspended -- HDCOPY4 cannot use the destination diskette. Remove it and insert a new one. Press <ENTER> and the copy re-starts at the current block of records. To abort the copy, press <@>.

File not on SOURCE drive - <ENTER> to continue -- the source drive does not have the file you specified. Perhaps it has a password or extension that you didn't enter. To return to the main menu, press <ENTER>.

SOURCE disk I/O error -- the record number shown on the screen contains an error. You can continue the copy by pressing <ENTER>. However, TRSDOS does not copy any record with an error and marks it as not copied in the destination file. To abort the copy, press <@>.

SOURCE file is empty - <ENTER> to continue -- the file exists but contains no records. Press <ENTER> to return to the main menu.

Unacceptable File Name -- you entered a filename which included a drive number. HDCOPY4 prompts you to enter the filespec again, without the drive number.

TECHNICAL INFORMATION

If a SOURCE I/O ERROR or a DESTINATION I/O ERROR occurs during HDCOPY4, the record where the error occurred is not copied. TRSDOS marks it as non-copied in the header record of the destination diskette and the copy may be continued.

An experienced programmer can reconstruct this data. The information below gives the layout of the header record that should be used for this purpose. This information should be sufficient for an experienced programmer.

Header Block

The first record of every destination disk contains a block of information arranged as described below:

	Bytes	Description
*	1 - 2	disk number in the copy set
	3 - 14	filename/ext
	15 - 31	time and date of copy, BASIC TIME\$ format
*	32 - 33	ending record number (original source file)
*	34 - 35	first source record (destination diskette)
*	36 - 37	last source record (destination diskette)
*	38 - 39	end of file offset (original source file)
	40 - 45	ASCII representation of a random number
*	46 - 47	Logical Record Length (source file)
	48 - 127	currently unused
*	128 - 256	Defective source file record numbers

* These fields are stored as compressed integers with the BASIC MKI\$ function.

Description

If any records were found to be bad, TRSDOS stores their record numbers as integers (2-byte fields) starting at byte 128 in the header block. The corresponding record of the destination file is marked with the message "HDCOPY4-BAD SECTOR".

To locate the bad record, determine the offset into the file by subtracting the starting record number (fifth field) from the bad record number. Then add one (1) since the first record always contains the header information. For example, if record 140 was bad, and the diskette contained the block of records 100 to 300, the bad record would be the 41st record in the file:

$$140 - 100 = 40 + 1 \text{ (header)} = 41\text{st record}$$

To repair the record, you must determine the original contents of the defective source file record. Then write this information to the proper record on the destination disk.

After the record is repaired, write zeroes over the bad record indication in the header (bytes 128-256). Follow this same procedure again if more records are bad.

If you do not correct all the records, the remaining 2-byte record numbers should be moved to the front of the field, starting at byte 128.



Appendix B / HARD DISK SPECIFICATIONS

Basically, the hard disk unit consists of two platters (or disks) lying parallel within the unit. There are also four Read/Write heads, one on each side of each platter. These heads move towards or away from the center of the disk as needed.

Hard disks have their own built-in error detection scheme. These errors are due to minor defects in the media as well as signals from external sources. When you purchase your hard disk, there will be no more than 3 tracks per head with defects, this will not exceed 8 tracks total per drive. Also there will not be any flaws on Track Ø.

On all hard disk units, flaws in the media are identified before the disk drives are delivered to you. Attached to the bottom of your hard disk unit is a DISK FLAW RECORD which specifies the errors on your particular unit. Do not throw this map away! You may want to refer to it when formatting the hard disk drive. Radio Shack service technicians may need to refer to it if your drive ever needs servicing.

Disks/Platters	2
Heads/Recording Surfaces	4
Tracks per Inch	254
Cylinders	153
Tracks	612

Bytes per Sectors	Sectors per Granule	Sectors per Track	Granules per Track	Tracks per Cylinder	Cylinders per Drive	Total Bytes
<hr/>						
256	-----	-----	-----	-----	-----	256
16	-----	(32)	2	-----	-----	4,096
				4	-----	8,192
					153	32,768
256	16	(32)	2	4	153	5,013,504
						5,013,504
						(4896K)

Disk RPM	3600
Recording Capacity Unformatted:	
Per Drive	6.38 Mbyte
Per Surface	1.59 Mbyte
Per Track	10.40 Kbyte
Recording Density (BPI)	7690
Step Rate	.01 ms
Access Time	
Max	175 ms
Track-to-Track	3 ms
Average	75 ms
Head Settling Time	15 ms
Disk Mechanical Dimensions	
Height	3.25 in
Width	5.75 in
Length	8.00 in
Hard Disk Drive Case Dimensions	
Height	14.00 in
Width	5.50 in
Length	15.00 in
Backwall Clearance Requirement	3 inches
Hard Disk Drive System Power	120 VAC, 60 HZ .90 AMPS
Disk Power	1.5 amps typical, 5 amps typical motor start.
+12V dc +/- 10%	1.5 amps typical
+5V dc +/- 5%	1.5 amps typical
Environmental Ambient Temperature	
Operating	16°C to 46°C 50°F to 115°F
Non-operating	-40°C to 60°C -40°F to 140°F
Relative Humidity	8% to 80%
Max. Wet Bulb Temperature	26°C without condensation

Appendix C/ PROBLEMS AND ERROR MESSAGES

This section lists the errors and problems you might encounter while using the computer.

If you get an error message which is not listed here, it is probably caused by your application program and will be listed in your application program manual.

IF YOUR COMPUTER BECOMES "HUNG-UP"

Your computer system might "hang-up" if you attempt to remove a diskette while the red access light is on.

If you want to continue the operation, re-insert the diskette and close the drive door. Then press <SHIFT> <BREAK> at the same time. If this doesn't work, press the RESET button.

IF AN ERROR MESSAGE APPEARS

TRSDOS gives an error message whenever it cannot perform an operation. This appendix lists the Boot error messages you are likely to encounter.

If you get an error message which is not on your list, it is either:

- a message from your application program -- see your application program manual
- a message from the individual TRSDOS command, utility, or feature you are using (see the individual command listing in the Disk System Owner's Manual, if the message is not self-explanatory.)

BOOT ERRORS

Boot Errors or no message - The disk you tried to boot from is blank or inserted incorrectly. Also check that the power is turned on to all parts of the system and that the drive door is closed.

Disk Error - This indicates that an error occurred during the loading of the operating system. Try again. If the problem still occurs, try a different diskette.

Error nn - This error indicates that part of the operating system could not be loaded during boot. Try a different diskette.

H - This indicates a problem with the hard disk. If the "H" is not flashing, the hard disk drive is turned off or disconnected. If the "H" is flashing, the drive has not yet reached its operating speed. When the drive is ready, the "H" disappears.

No System

Not a system disk - These errors indicate that you've tried to boot your system with a data disk instead of a system disk.

No Message - If a message does not appear and the system does not load, check to make sure that there is a system or boot disk in Drive Ø. Also see that the disk is inserted correctly and that the drive door is closed.

Appendix D/ TECHNICAL INFORMATION -- System Configuration

The initialization procedure for the hard disk (HARDGEN) sets up a system configuration using a specified pattern. Since these patterns are limited, you may want to configure your system differently. To do this you must initialize your hard disk drive manually. This section provides information on the various functions you need to custom configure your system.

The first thing you should do is to read this section completely before attempting to reconfigure your hard disk drives. You should have already made backup copies of your TRSDOS diskette and hard disk drives.

For more information on some of the commands used in this section, refer to your Disk System Owner's Manual.

Drive Storage Space

The Hard Disk Operating System allows you to partition a drive into separate logical drives, based on the number of read/write heads. Your Five Megabyte Hard Disk has four heads. The total storage space per logical drive is:

Number of Heads per Logical Drive	Approximate Storage Space
1	1.25 megabytes
2	2.5 megabytes
3	3.75 megabytes
4	5.0 megabytes

During the manual system configuration process, you are able to select the number of heads to assign to a logical drive, thereby selecting a drive size and the total number of drives based on your actual needs.

Initial Drive Configuration

Configuring your hard disk will require five steps:

1. setting the logical number and size of the drive
2. formatting the drive
3. moving the operating system to the hard disk
4. making the hard disk the system device
5. storing the configuration on the Boot diskette.

You should reset using a backup copy of the Hard Disk INITIALIZATION diskette. This is because the data on your hard disks may not be available during this process.

Use the SYSTEM library command to set the logical drive number and size of the drive. The syntax is:

```
SYSTEM (DRIVE=n,DISABLE,DRIVER="TRSHD4")
```

The n represents the desired logical drive number. It can be any number between 1 - 7. Zero (\emptyset) cannot be used as a logical drive number.

SYSTEM displays the following questions one at a time. Your answers determine how your logical drives will be set up.

NOTE: Pressing <BREAK> as a response to any of the prompts causes the procedure to abort back to TRSDOS Ready.

1. Enter drive select address <1-4>
This selects the proper hard disk drive. If you have more than one hard disk, the select address values correspond to the first through the fourth drives. If you have only one hard disk drive, it is select address 1.
2. Enter total number of heads on drive <1-8>
This allows you to select the number of heads, and thus the size, of the logical drive. You may enter any number between 1 and 8, depending on the amounts of storage you want for the logical drive. If you have already assigned some of the heads on this hard disk, the prompt is skipped.

3. Enter Physical tracks per surface:

You should enter the number of tracks per platter for your drive. This information can be found in the Specifications Appendix. If you have already defined a logical drive on this disk, this prompt is skipped.

4. Enter step rate for drive:

Enter the number for the seek rate in milliseconds. For example, .01ms is entered as simply <.01>. This information can be found in the Specifications Appendix. SYSTEM only asks this question for the logical drive assignment on a hard disk drive.

5. Heads already in use <.-.-.->

Enter number of heads for partition <1-n>

Enter starting head:

This display shows you the heads you have already assigned, and allows you to select the number of heads to assign to the next logical drive. You also enter the starting head number for the partition. It makes no real difference which head number you start with, but it is recommended to start with 1 and work up to the higher numbered heads. For example, if you had already assigned heads 3 and 4 , the display would show:

Heads already in use <.-.-3-4> Enter starting head >

If you were currently assigning one head, you could specify either head 1 or 2. However, if you were assigning two heads, you must specify head 1. Specifying heads that are in use, or specifying a starting head that causes an overlap of existing assigned heads is not allowed. The following message displays:

Heads requested conflict with heads in-use!

You are then prompted to enter the correct head number. If you specify 4 heads and the drive has only 4 heads available, you will not be prompted to enter a starting head.

This procedure should be repeated until you have assigned all heads.

To store this configuration so that it automatically loads every time you start-up or reset the computer, type:

SYSGEN (DRIVE=n) <ENTER>

This command stores the drive configuration and the status of several other features onto the diskette in Drive n. This diskette must be a system disk. When you are ready to boot your system, move the diskette to Drive \emptyset , the first floppy drive, and press **<RESET>**. See **SYSTEM in your Disk System Owner's Manual** for more information on the **SYSGEN** command.

Formatting the Hard Disk Drive

There is a special hard disk formatting program provided on your Hard Disk Operating System diskette called **TRSFORM4/CMD**. This program is used to format the logical drives assigned in the previous steps. To execute the program, type:

TRSFORM4 <ENTER>

You are now asked the following questions:

NOTE: Pressing **<BREAK>** as a response to any of the prompts causes the procedure to abort back to TRSDOS Ready.

1. **Which drive is to be used ?**
Enter the logical drive number (1-7) you assigned to the drive.
2. **Disk Pack name?**
Enter up to 8 characters or numbers to be used as the disk name. The first character must be a letter.
3. **Master Password?**
Enter in the master password you want assigned to the disk. For hard disks, it is recommended that the password be something other than **PASSWORD**. This keeps you from inadvertently re-formatting the disk.

If you have previously formatted the hard disk drive, this message displays:

4. Disk contains data - Name=diskname Date=mm/dd/yy
This is the last point at which you can abort the formatting. The system may ask for the Master Password or if you are ready to format the disk. Answer the prompt with accordingly. To abort the process, press <BREAK>.
5. Lock out track manually <Y/N>:
This lets you enter your hard disk's Media Error Map located on the bottom of your drive. This records the tracks marked bad by the manufacturer. Enter <Y> if you want to enter this information and these prompts appear:

Enter physical head number <1-n>
Enter physical track number <1-n>

Respond to these prompts by entering the information from the Media Error Map. You are asked if you want to lock out more tracks. If you want to enter another flaw, type <Y><ENTER>; otherwise press <N><ENTER>.

TRSDOS now formats and verifies the hard disk. The verification process takes more time than it does on a floppy diskette. TRSDOS automatically locks out any defective areas (see Appendix D for more information on flaws).

Upon completion, the directory information is put on the drive.

Moving TRSDOS Version 6 To Your Hard Disk

Follow these steps to set up TRSDOS on your hard disk:

1. Insert a backup of the Model 4 Hard Disk Initialization diskette into Floppy Drive Ø. Make sure it is a backup of the master.

2. Use the BACKUP command to move the TRSDOS files from the backup of the Model 4 Hard Disk Initialization diskette to your hard disk. Type:

```
BACKUP :Ø :hd (S,I) <ENTER>
```

where hd is the logical drive number of the hard disk to contain the operating system.

3. When the backup is complete, type at TRSDOS Ready:

```
SYSTEM (SYSTEM=hd) <ENTER>
```

where hd is the hard disk that contains the operating system. This tells TRSDOS to look for the operating system of hard disk Drive hd. In otherwords, TRSDOS now goes to the first hard disk as logical Drive Ø.

4. At TRSDOS Ready, type:

```
SYSGEN (DRIVE=fd) <ENTER>
```

where fd is new logical drive number of the first floppy drive (the one with the Model 4 Hard Disk Initialization diskette in it). This command tells TRSDOS to write the configuration file the floppy diskette in Drive fd. Notice that fd is the same drive as given in step 3.

Using the TRSDOS JCL for Hard Disk Drive Setup

You can setup hard disk drives with a JCL file. You must properly align the responses to the setup prompts as lines in a JCL file. As an example, refer to the following lines, which would be built into a JCL file:

```
SYSTEM (DRIVE=4,DISABLE,DRIVER="TRSHD4")
4
153
.5
1
2
1
```

This example specifies a drive with 4 heads, 153 tracks that steps at .5ms. and is physical drive 1. It assigns 2 heads to logical drive number 4, starting with the first head (head 1). This procedure can be repeated in the file to assign as many heads/drives as you want.

Note that all of the prompts do not appear in some cases. See Initial Drive Configuration for details.



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